Aquaponics

HORT 4601

University of Minnesota
Driven to Discover℠

A Cost-Benefit Analysis of Heating Fish Tanks Through Winter in a Mid-Western Greenhouse Aquaponics System

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Introduction

- *Warm-water fish species require their tanks to be artificially heated, which can result in significant electricity bills.*
- *Tilapia, the most commonly grown fish in aquaponics and a warm-water species, prefers an optimum temperature of 25-30˚C*
- *Perch prefer a lower ambient temperature of 21-27˚C*
- *Producers could avoid large water heating bills by growing fish that require lower water temperatures.*

Objective

To discover whether or not it is significantly more profitable to raise cold-water fish species rather than warm-water species by avoiding the external cost of heating the tanks, in Midwestern aquaponics systems.

Methods

- *4 tanks of Tilapia and 4 tanks of Yellow Perch*
- *Tanks held at two temperatures:*
  - *23˚C (Ambient)*
  - *26˚C (Heated)*
- *Fish weights/lengths recorded weekly for 8 weeks*
- *Energy consumption recorded by "Kill-A-Watt" Electricity Usage Monitors*
  - *Minneapolis rate: 11.35 cents/kWh*

The layout of the tanks within the greenhouse:

Tank 2-5 Tilapia 26 C	Tank 2-4 Yellow Perch 26 C
Tank 2-6 Yellow Perch 23 C	Tank 2-3 Tilapia 23 C
Tank 2-7 Yellow Perch 26 C	Tank 2-2 Tilapia 26 C
Tank 2-8 Tilapia 23 C	Tank 2-1 Yellow Perch 23 C

Yellow Perch (*Perca flavescens*)

Tilapia (*Oreochromis aureus*)

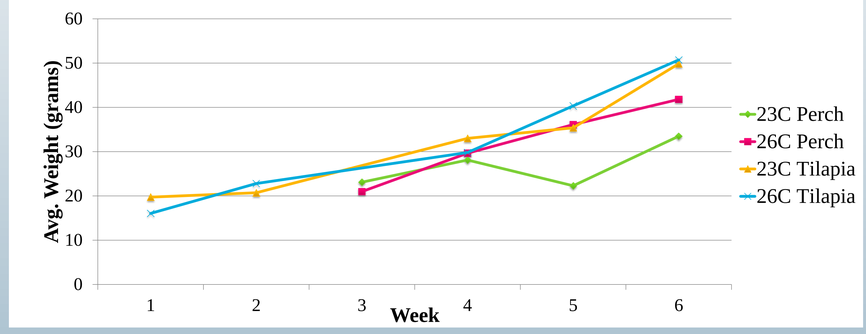


Figure 1.Growth of Tilapia (Oreochromis aureus) and Yellow perch (Perca flavescens) observed over 6 weeks.

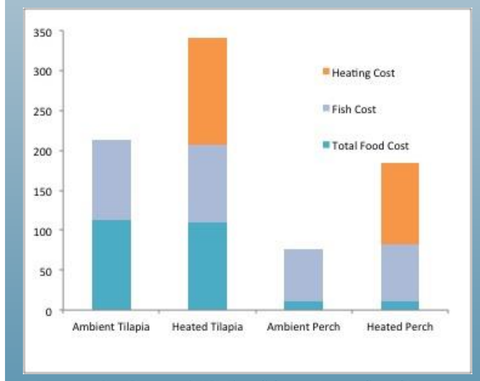


Figure 2. Costs (USD) of heating, feeding, and initial price of fish.

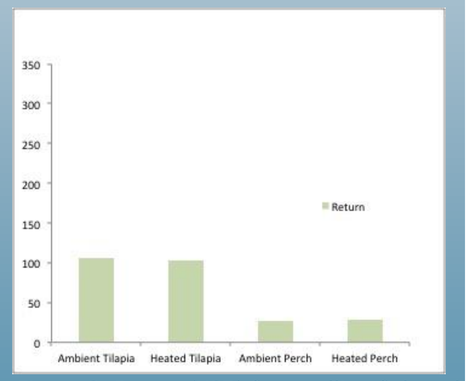
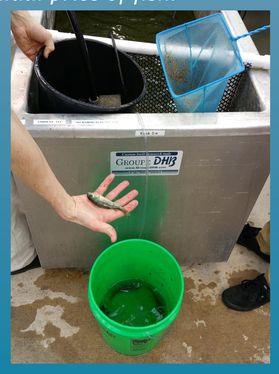


Figure 3. Return (USD) from selling fish and produce.



Results & Discussion

The cost-benefit analysis included initial price of fish, shipping, fish food, and heating costs. Fish weights were extrapolated to their harvestable size and a food conversion ratio was determined. The following ratio was the result:

Profit Ratio (Return/Cost):

- *Heated perch: 0.155*
- *Ambient perch: 0.342*
- *Heated tilapia: 0.303*
- *Ambient tilapia: 0.498*

Taking into account the high cost of heating rearing tanks, it is not financially beneficial to heat either tilapia or perch tanks in a mid-western aquaponics system throughout the winter. The return on heated tanks was half the return of the ambient tanks.

Recommendations

- *The increased fish weight that is gained from heating tanks does not make up for the overall heating costs. It is not necessary to artificially heat tanks for tilapia or perch.*
- *When choosing a species for an aquapoincs system, take into account the climate of the region. Choose species that prefer a temperature that is characteristic of the region.*
- *It was observed that perch are much less 'hygienic' than tilapia, and produced awful smells and poor water quality, which were negative qualities.*

Acknowledgements

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Credit for perch and tilapia pictures
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